



Geographical variation in pelage characteristics in *Presbytis comata* (Desmarest, 1822) (Mammalia, Primates, Cercopithecidae)

By V. NIJMAN

Institute for Systematics and Population Biology, Zoological Museum, University of Amsterdam, Amsterdam, The Netherlands

Receipt of Ms. 19. 07. 1996
Acceptance of Ms. 07. 03. 1997

Abstract

In the traditional view, two subspecies of *Presbytis comata* are present on the island of Java, Indonesia. The nominate form is found in West Java, while on Central Java *P. c. fredericae* is recognised. Geographical variation in *P. comata* has been studied both in museum specimens and in the field. Some alleged differences between the two described forms were found not to be diagnostic, while some intraspecific variation was of a clinal nature, with intermediate populations existing in the eastern part of West Java. It is concluded that a separation of *P. comata* into different subspecies or even species is not warranted.

Introduction

On the island of Java, Indonesia, two single island endemic primate species can be found, both classified as endangered according to I.U.C.N. threat criteria (EUDEY 1987): the Javan gibbon *Hylobates moloch* and the Javan grizzled leaf monkey *Presbytis comata* (formerly *P. aygula*, see WEITZEL and GROVES 1985). The latter species is the subject of this study. Javan grizzled leaf monkey is confined to the rainforests of the western half of the island while some remnant populations are found as far east as Mt. Lawu, on the border of East Java (for a review, see NIJMAN 1997).

Two subspecies are traditionally recognised: *P. comata comata* (Desmarest, 1822), locally known as Surili, restricted by SODY (1930b) to West Java, and *P. comata fredericae* (Sody, 1930), locally known as (Lutung) Rekrakan, from Central Java. EUDEY (1987) states that *P. c. fredericae* is known with certainty only from Mt. Slamet, although BARTELS (1937) reported the occurrence of the species on Mts Dieng and some specimens have been collected on Mts Dieng and Mt. Lawu. During the last few years it has become apparent that *P. comata* still prevails in those areas in Central Java from which it was historically known (SEITRE and SEITRE 1990; NIJMAN and SÖZER 1995; NIJMAN 1997). Recently *P. c. fredericae* has been proposed as a separate species *P. fredericae* by I. U. C. N. (1994) and BRANDON-JONES (1995, 1996). The pelage colour of adults is the most striking difference between the two types: *fredericae* differs from the nominate race in having black upper parts instead of grey, and the under parts are black apart from the lower abdomen, innerside of the legs, which are white, and the upper part of the chest, which is whitish or light grey. Hence, the proposed English names of Javan grizzled leaf monkey for *P. comata* and Javan fuscous leaf monkey for *P. fredericae* (I. U. C. N. 1994). If *P. c. fredericae* is considered to be a separate species it undoubtedly can be ranked among the rarest and most endangered primate species in the world, making it a top priority for

primate conservation (cf. BRANDON-JONES 1995). It would be restricted to four isolated forest areas viz. Mt. Slamet, Mt. Cupu-Simembut, Mts. Dieng and Mt. Lawu (NIJMAN 1997), in a province with one of the highest human population densities of Indonesia. None of the forests are adequately protected and two of them, the first and the latter of the localities mentioned above, are situated on an active volcano.

The aim of this study is to describe the geographical variation in pelage characteristics that can be observed among populations of *P. comata*. Data collected in the central parts of Java, combined with data obtained from the study of museum specimens, form the basis of these descriptions.

Material and methods

A total of 52 museum specimens in the National Museum of Natural History, Leiden (RMNH), the Zoological Museum, Bogor (MZB), and the British Museum of Natural History (BMNH), London were examined, viz. 29 from the western province and 10 from the central Javan province. For another 13 specimens studied, no locality was given.

During surveys over a 10-month period in 1994 and 1995 in the central part of Java, i.e. the eastern part of West Java, Central Java, and the western part of East Java, descriptions of external appearance and pattern of coloration of *P. comata* were made. Populations in the western half of West Java were studied in order to obtain data on the external appearances of the species in this area. The number of animals and number of neonates of which a clear view was obtained per mountain complex was estimated by summation of the maximum number of individuals observed at different localities throughout the mountain complex. When a group was observed at a locality where it had been seen previously or when there was doubt whether a particular animal was previously encountered or was in fact a different individual, a description was made, but it was not included in the total estimate of numbers. No specimens were collected and the descriptions are exclusively based on field observations and museum specimens.

Results

P. comata was observed in 6 forest areas. The areas in which the species was observed included (estimated numbers of clearly observed individuals plus neonates are given in parenthesis): Mt. Pancar (5), Mt. Gede-Pangrango (20 + 3), Mt. Sawal (3 + 1), Mt. Slamet (16 + 3), Mts. Dieng (29 + 3), Mt. Lawu (0).

Typical *P. comata comata* from the western part of West Java (e.g. Mt. Pancar [106°54' E, 6°35' S], Mt. Gede-Pangrango [107°00' E, 6°45' S]) has a rather dark grey dorsum with the hair on the back being longer than on the tail, legs and arms. The tail is dark grey to blackish, and arms and legs are dark grey, often darker than the back. The venter, innerside of arms and legs, and innerside of the tail are whitish. The species has a blackish prominent crest. In some individuals the hair on the back is rather short while in others it is longer. In individuals with longer hair the upper-coat is formed by longer dark grey or blackish hair while the under-coat consists of short dark grey hair.

In some individuals the white venter is intermingled with some grey hairs originating from the flanks, and the impression arises that the venter of animals from the western part of West Java (e.g. Mt. Salak [106°45' E, 6°45' S]: RMNH 34 335, 34 336, 34 338, 51 891) is less intermingled with grey than in specimens originating from areas somewhat further to the east e.g. in the mountains south of Bandung (e.g. Mt. Tilu [107°30' E, 7°09' S]: RMNH 26 820). However, as no field observations were made in the latter area, the question to what extent the venter shows greyish parts in these areas must remain unanswered.

P. comata from Mt. Sawal [108°16' E, 7°12' S] in the eastern part of West Java, is somewhat different in colouration from those in areas to the west and to the east. The dorsum

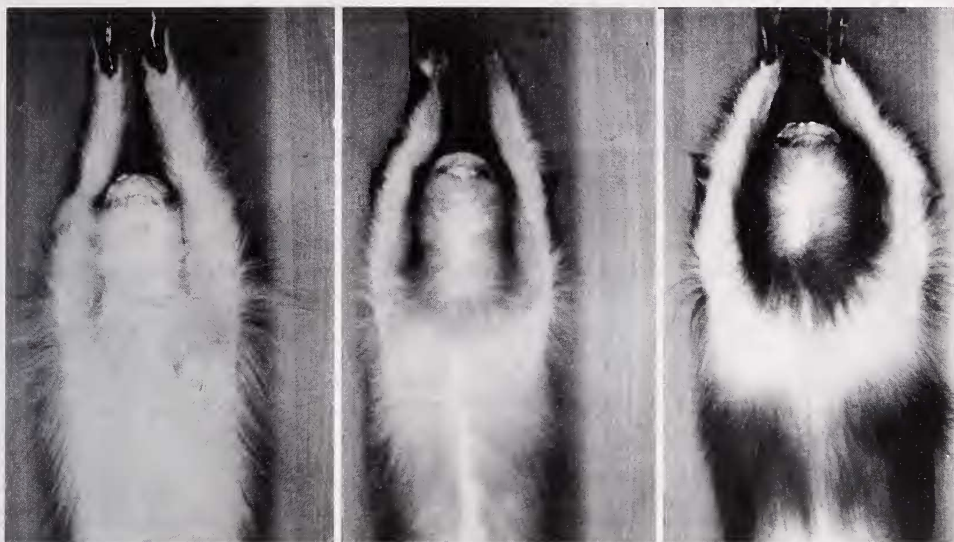


Fig. 1. Geographical variation in pelage characteristics of the venter in *Presbytis comata*. From left to right: RMNH 26824, Tapos, Mt. Salak, West Java; RMNH 34296, Ceringin, West Java near border with Central Java; RMNH 34346, Tegal Sari, Mt. Slamet, Central Java.

is not different from animals to the west, although in the animals studied it is rather dark. The arms are very dark grey, almost black. The venter consists of a whitish or light grey throat, edged on the upper side of the breast by a broad grey band. This band originates from the flanks and is narrower in the centre, with a thin whitish cross band. The lower abdomen, innerside of arm, legs and tail are whitish. The same pattern of coloration, but less pronounced, was found in a skin labelled *P. aygula aygula* and collected at Ceringin/Cisaga [108°30' E, 7°27' S] near Banjar, West Java, near the border with Central Java (RMNH 34296) (Fig. 1). This individual has rather dark arms, although at Mt. Sawal the animals had even darker arms.

In typical *P. comata fredericae* from Mt. Slamet [109°13' E, 7°19' S] or Mt. Prahua [109°55' E, 7°20' S] (e.g. MZB 2993, 2994, 2995, RMNH 14612) the dorsum is black, the throat and upper chest are white or light grey, the lower abdomen, innerside of the legs, arms and tail are white, while the remainder is black with a thin nearly white cross band. At the lower elevations of Mts. Dieng, near the village of Linggo, the same black form is present, but most of the animals are less dark in colour. The pattern of coloration is the same as in the typical form, but the dorsum is more greyish, not black, and resembles those of the Mt. Sawal animals. For an overview of pelage characteristics based on field observations, see table 1.

P. comata has been observed in both primary and secondary forest, in ecotones and in the forest interior. The species is present in lowland forests, in forests on steep slopes and hills, and in montane and upper montane forests. There is no differentiation in habitat or altitudinal preferences between populations in the east or west. In behavioural terms all forms are indistinguishable from one another. Most notably the vocalisations, in particular the alarm call, of animals on Mt. Gede-Pangrango, Mt. Sawal, Mt. Slamet, Mts. Dieng and Mt. Lawu are qualitatively similar (cf. BARTELS 1937). In other *Presbytis* species, e.g. those on Sumatra, the different species are readily distinguished by their specific vocalisations (see e.g. WILSON and WILSON 1977; AIMI and BAKAR 1992, 1996).

SODY (1930b) noted that inhabitants of the Mt. Slamet region, where he obtained the specimens described as *fredericae*, were not familiar with the Javan native name Surili,

Table 1. Pelage characteristics of *Presbytis comata* based on field observations on 5 mountain complexes on Java, listed from west to east. The number of individuals of which a clear view was obtained is given in parenthesis.

locality	venter	dorsum	arms	dorsum neonate
Mt. Pancar	white (4)	(dark) grey (5)	dark grey (5)	–
Mt. Gede-Pangrango	white (20)	(dark) grey (20)	(dark) grey (20)	grey (3)
Mt. Sawal	white with dark grey band on breast, narrow in centre (3)	dark grey (3)	blackish (3)	dark grey (1)
Mt. Slamet	white with black band on breast (16)	black (16)	black (16)	black (3)
Mts Dieng	white with dark grey band on breast (22)	dark grey (22)	dark grey (22)	dark grey (3)
	white with black band on breast (2)	black (7)	black (7)	–

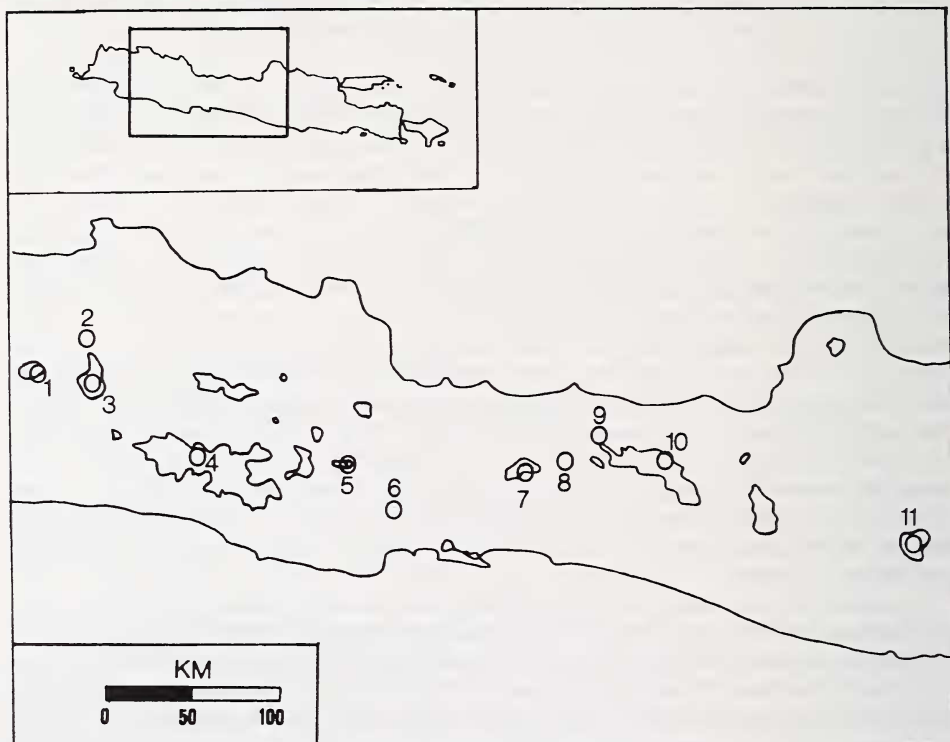


Fig. 2. Map of the central part of Java, Indonesia, with the localities mentioned in the text. Key: 1. Mt. Salak; 2. Mt. Pancar; 3. Mts Gede-Pangrango; 4. Mt. Tilu; 5. Mt. Sawal; 6. Ceringin/Cicaga; 7. Mt. Slamet; 8. Mt. Cupu-Simembu; 9. Linggo; 10. Mt. Prah (the area between Linggo and Mt. Prah is known as Mts Dieng); 11. Mt. Lawu. The drawn lines on the map indicate the 1 000 m contour lines.

nor did they make a linguistic distinction between *P. comata* and the sympatric Ebony leaf monkey *Trachypithecus auratus*; both species were named Lutung (SODY 1930a). In West and Central Java, and Bali, Lutung is the name used for the more common and more widespread Ebony leaf monkey, while in East Java it is named Budeng. BARTELS (1937) reported that *P. comata* was known as Rekrekan in the Mts. Dieng region. Interviews with people living near the forest areas by the present author revealed that *P. comata* is locally known as Surili east to Mt. Sawal, and from Mt. Slamet to Mts. Dieng it is known as (Lutung) Rekrakan/Rekrekan. In some areas, e.g. on Mt. Prahū and Mt. Lawu, some informants were aware of the presence of two types of leaf monkeys, but both of them were called Lutung (Mt. Prahū and Mt. Lawu) or Budeng (Mt. Lawu). The linguistic separation between *fredericae* and *comata* in Rekrakan and Surili respectively, is accounted for by the two different languages, Javanese and Sundanese, spoken in different parts of the island and is not of biological significance. The name Rekrakan, however, is also used for the red form of the Ebony leaf monkey in the Malang region, East Java (RUDIYANTO, pers. comm.).

Discussion

Intraspecific variation, in particular the coloration and pattern on the venter, in *Presbytis comata* is not geographically disjunct but seems to be of a clinal nature with intermediate populations existing in areas between those from where the two subspecies have been described. Whether or not more populations of the species remain in these intermediate areas remains unclear. Since today large areas of Java have been deforested, populations of *P. comata* are found scattered throughout West and Central Java. However, there seems to be no major gap in the species distribution between West Java and Central Java, nor does there seem to be a geographical or ecological barrier in the intermediate area that can explain a possible separation between populations east or west of the provincial boundary.

One of the morphological characters on which the separation between *comata* and *fredericae* has been based, namely the dorsal coloration, shows, at least in the populations on the Dieng mountains, considerable variation and cannot be used as a diagnostic character.

On the basis of the data presented above, it can be concluded that the separation of western and eastern populations of *P. comata* into two different species is not warranted. Neither form can be recognised as a diagnosably distinct taxon and therefore the appropriate name for the species remains *P. comata*. For those who do not wish to abandon the use of trinomials, it should be understood that these can only be used to identify populations within a continuum of geographical variation. The geographical limits of these populations will, however, remain arbitrary.

The tripartite distribution of the grey leaf monkeys of the genus *Presbytis* in the Sundaic region, currently known as *comata* (western Java), *thomasi* (northern Sumatra), and *hosei* (northeastern Borneo), has been a long-time issue of debate. POCOCK (1934) considered these taxa as constituting four different species, including two on Borneo (*sabana* and *hosei*: in Borneo some populations show adult sexual dimorphism in crest shape and extent of white on the brow while others are monomorphic, resulting in the description of a number of (sub)species). CHASEN (1940) subsequently considered them to be races of a single species, *P. comata*, as did some authors afterwards, e.g. HOOPER (1962). This made *P. comata* a polytypic species, with a distribution following the periphery of Sundaland. The three zones were regarded as areas of convergent evolution by MEDWAY (1970) and in his more cautious interpretation the three forms (*comata*, *thomasi*, and *hosei*) were considered to be separate species, a view supported by GROVES (1970) and most subsequent workers (NAPIER 1985;

WEITZEL et al. 1988; CORBET and HILL 1992; I. U. C. N. 1994). In contrast, BRANDON-JONES (1978, 1984, 1993, 1996), regarded them as relicts of a single population, differentiated at the subspecific level, in which the grey-backed taxon is perceived as a relict in its present disjunctive distribution, representing an earlier coloniser of the Sundaic region. BRANDON-JONES (1993) postulated that the phylogeny of the genus involves unidirectional integumental colour degradation, comparable with HERSHKOVITZ' (1968) theory of metachromism. In this view the pelage colour of the preglacial relict species in the genus *Presbytis* is predominantly black (BRANDON-JONES 1978, 1993), after which bleaching occurs via the eumelanin pathway from (brown to) grey to white (HERSHKOVITZ 1968). Thus, those mammalian species that are characterised by a very dark/black coloration can, generally, be regarded as progenitors of all living members of their group. If we follow the BRANDON-JONES (1987, 1993) model and accept the predominant glossy black *P. potenziani*, from the Mentawai islands of the west coast of Sumatra, as the sole representative of the genus during a Pleistocene period of climatic deterioration, after which it evolved (or "degenerated" as preferred by BRANDON-JONES 1993) into the grey *P. comata* (sensu lato) then the present occurrence of melanistic individuals in that taxon needs further explanation.

The present finding of populations intermediate in coat coloration and pattern and the presence of greyish individuals in the easternmost populations of *P. comata*, show that the species is more variable in its pelage coloration than previously assumed. If *P. comata* from Java is considered conspecific with *P. thomasi* and *P. hosei*, intraspecific variation in pattern and coloration below the head (which is generally more conservative than the pelage colour itself: WILSON 1978; WILSON and WILSON 1977) in the Javan populations would be larger than variation between *comata*, and extralimital *thomasi* and *hosei*.

In conclusion, *P. comata* on Java cannot be separated into two different subspecies or even species as neither form can be recognised as a diagnosably distinct taxon. Moreover, the large variation in pelage characteristics within the Javan populations makes it increasingly more difficult to consider them conspecific with the other grey-backed leaf monkeys – *P. thomasi* and *P. hosei* – from north Sumatra and northeastern Borneo, respectively.

Acknowledgements

I wish to thank Mr BOEADI of the Zoological Museum Bogor, Dr C. SMEENK of the National Museum of Natural History, Leiden, and Miss P. JENKINS of the British Museum for Natural History, London for allowing me to examine specimens in the collections under their care, Dr P. J. H. VAN BREE, SARA BOOTH, Dr C. J. HAZEVOET and an anonymous reviewer for constructive comments on the manuscript, and STEPHAN KÖNEMANN for the German translation of the abstract. Research on Java was made possible due to the co-operation of the Indonesian Institute for Science (LIPI) and the Directorate General of Forest Protection and Nature Conservation (PHPA). Finally, Dr P. J. H. VAN BREE is thanked for his help and support throughout the study.

Zusammenfassung

Geographische Variation von Fellbesonderheiten bei Presbytis comata (Desmarest, 1822) (Mammalia: Primates: Cercopithecidae)

Aus traditioneller Sicht sind zwei Unterarten von *Presbytis comata* auf der Insel Java beschrieben. Während *P. c. comata* in West-Java gefunden wird, gilt *P. c. fredericae* als anerkannte Unterart Zentral-Javas. Die geographische Variation von *P. comata* wurde sowohl im Feld als auch anhand von Museumsmaterial studiert. Es stellte sich heraus, daß manche Unterschiede der beiden beschriebenen

Formen nicht diagnostisch verwertbar waren, während einige intraspezifische Variationen, bei Berücksichtigung von intermediären Populationen, einen klinalen Charakter besaßen. Es kann die Schlußfolgerung gezogen werden, daß die Trennung der zwei Formen in verschiedene Unterarten oder Arten nicht gerechtfertigt ist.

References

- AIMI, M.; BAKAR, A. (1992): Taxonomy and distribution of *Presbytis melalophos* group in Sumatera, Indonesia. *Primates* **33**, 191–206.
- AIMI, M.; BAKAR, A. (1996): Distribution and deployment of *Presbytis melalophos* group in Sumatera, Indonesia. *Primates* **37**, 399–409.
- BARTELS, M. (1937): Zur Kenntnis der Verbreitung und der Lebensweise javanischer Säugetiere. *Treubia* **16**, 149–164.
- BRANDON-JONES, D. (1978): The evolution of recent Asian Colobinae. In: *Recent advances in primatology*, Vol 3: Primate evolution, Proceedings of the sixth congress of the International Primatological Society, 1976. Ed. by D. J. CHIVERS and K. A. JOYSEY. London: Academic Press. Pp. 323–325.
- BRANDON-JONES, D. (1984): Colobus and leaf monkeys. In: *The encyclopaedia of mammals*. Vol. 1. Ed. by D. MACDONALD. London: Allen and Unwin Pp. 398–408.
- BRANDON-JONES, D. (1993): The taxonomic affinities of the Mentawai Islands Surili, *Presbytis potenziani* (Bonaparte, 1856) (Mammalia: Primates: Cercopithecidae). *Raff. Bull. Zool.* **41**, 331–357.
- BRANDON-JONES, D. (1995): *Presbytis fredericae* (Sody, 1930), an endangered colobine species endemic to Central Java, Indonesia. *Primate Conserv.* **16**, 68–70.
- BRANDON-JONES, D. (1996): The Asian Colobinae (Mammalia; Cercopithecidae) as indicators of Quaternary climatic change. *Biol. J. Linn. Soc.* **59**, 327–350.
- CHASEN, F. N. (1940): A handlist of Malaysian mammals. *Bull. Raffles Mus.* **15**, 1–209.
- CORBET, G. B.; HILL, J. E. (1992): The mammals of the Indomalayan region: a systematic review. Oxford: Nat. Hist. Mus. Publ. Oxford Univ. Press.
- EUDEY, A. A. (1987): Action plan for asian primate conservation: 1987–1991. Gland: IUCN/SSC Primate Specialist Group.
- GROVES, C. P. (1970): The forgotten leaf-eaters, and the phylogeny of the Colobinae. In: *Old World monkeys: evolution, systematics and behavior*. Ed. by J. R. NAPIER and P. H. NAPIER. New York: Academic Press. Pp. 555–587.
- HERSHKOVITZ, P. (1968): Metachromism or the principle of evolutionary change in mammalian tegumentary colors. *Evolution* **22**, 556–575.
- HOOIJER, D. A. (1962): Quaternary langurs and macaques from the Malay Archipelago. *Zool. Verh. Leiden* **55**, 1–64.
- I. U. C. N. (1994): Preliminary list of Asian primate taxa (November 1994). Gland: I.U.C.N./S.S.C. Primate Specialist Group.
- MEDWAY, LORD (1970): The monkeys of Sundaland: ecology and systematics of the cercopithecids of a humid equatorial environment. In: *Old World monkeys: evolution, systematics and behavior*. Ed. by J. R. NAPIER and P. H. NAPIER. New York: Academic Press. Pp. 513–553.
- NAPIER, P. H. (1985): Catalogue of primates in the British Museum (Natural History) and elsewhere in the British Isles. Part III: Familie Cercopithecidae, subfamily Colobinae. London: British Museum (Natural History).
- NIJMAN, V. (1997): On the occurrence and distribution of *Presbytis comata* (Desmarest, 1822) (Mammalia: Primates: Cercopithecidae) in Java, Indonesia. *Contr. Zool.*, Amsterdam (in press).
- NIJMAN, V.; SÖZER, R. (1995): Recent observations of the Grizzled leaf monkey (*Presbytis comata*) and an extension of the range of the Javan gibbon (*Hylobates moloch*) in Central Jawa. *Trop. Biodiv.* **3**, 45–48.
- POCOCK, R. I. (1935): The monkeys of the genera *Pithecus* (or *Presbytis*) and *Pygathrix* found to the east of the Bay of Bengal. *Proc. Zool. Soc. Lond.* **1934**, 895–961.
- SEITRE, R.; SEITRE, J. (1990): Recent sightings of rare primates on Java. *Primate Conserv.* **11**, 18.
- SODY, H. J. V. (1930 a): *Pithecus aygula fredericae* n. subsp. *Trop. Natuur* **19**, 68.
- SODY, H. J. V. (1930 b): On some new and insufficiently known mammals from Java, Borneo and Celebes. *Natuurkd. Tijdschr. voor Ned. Indië* **90**, 258–273.

- WILSON, W. L. (1978): Variation among primate populations in Sumatra. In: Recent advances in primatology. Vol 3: Primate evolution, Proceedings of the sixth congress of the International Primatological Society, 1976. Ed. by D. J. CHIVERS and K. A. JOYSEY. London: Academic Press. Pp. 311–313.
- WILSON, C. C.; WILSON, W. L. (1977): Behavioral and morphological variation among primate populations in Sumatra. *Yb. Phys. Antropol.* **20**, 207–233.
- WEITZEL, V.; GROVES, C. P. (1985): The nomenclature and taxonomy of the colobine monkeys of Java. *Int. J. Primat.* **6**, 399–409.
- WEITZEL, V.; YANG, C. M.; GROVES, C. P. (1988): A catalogue of primates in the Singapore Zoological Reference Collection, Department of Zoology, National University of Singapore (formerly the Zoological Collection of the Raffles Museum). *Raffles Bull. Zool.* **36**, 1–166.

Author's address: VINCENT NIJMAN, Institute for Systematics and Population Biology, Zoological Museum, University of Amsterdam, P.O. Box 94766, 1090 GT Amsterdam, The Netherlands.